Diet of striped sea bream *Lithognathus mormyrus* (Sparidae) from eastern central Adriatic Sea

by

Mate ŠANTIĆ* (1), Antonela PALADIN (1) & Gordana ELEZ (2)

ABSTRACT. - The diet of striped sea bream, *Lithognathus mormyrus* (Linnaeus, 1758), from the central Adriatic Sea, was investigated with respect to fish size and seasons. Stomach contents of 524 specimens, total length (TL) from 12.8 to 31.7 cm, collected by trammel bottom nets and gill nets from January to December 2008, were analysed. The overall percentage of empty stomachs (17.7%) evidenced variation with seasons, maximum during winter (30.0%) and minimum during summer (8.3%). The prey belong to eight major groups: Gastropoda, Bivalvia, Polychaeta, Decapoda, Amphipoda, Copepoda, Echinodermata and Teleostei. Bivalves were the most important ingested prey in all seasons in the length class from 16 to 26 cm TL. Small prey like amphipods and copepods constituted the main prey of fish less than 16 cm TL. Conversely, the proportion of decapods and teleosts increased in the largest size class (> 26 cm TL). Bivalves, *Dosinia lupinus* (%IRI = 6.8) and *Telinella pulchella* (%IRI = 3.1) and a decapod, *Liocarcinus depurator* (%IRI = 2.6), were the most frequent prey. Diet composition showed little seasonal variation; bivalves were the most important prey in all seasons, but especially during winter. The lowest feeding frequency recorded in winter could be related to lower sea temperature. Striped sea bream is an active seeking bottom feeder whose diet consists of diverse benthic groups, with wide range of size and morphology.

RÉSUMÉ. - Régime alimentaire du marbré, *Lithognathus mormyrus* (Sparidae), en mer Adriatique centrale.

Le régime alimentaire de *Lithognathus mormyrus* en mer Adriatique a été étudié en fonction de la taille des poissons et de la saison. Les contenus stomacaux de 524 spécimens (12,8-31,7 cm LT), capturés par une petite seine de plage de janvier à décembre 2008, ont été analysés. Au total, 93 estomacs étaient vides (17,7%). Ce pourcentage a significativement changé selon les saisons, avec un nombre maximum d'estomacs vides enregistré pendant l'hiver (30,0%) et un nombre minimum enregistré pendant l'été (8,3%). Le contenu stomacal de *Lithognathus mormyrus* est composé de 8 groupes principaux de proies : les mollusques gastropodes et bivalves, les annélides polychètes, les crustacés décapodes, copépodes et amphipodes, les échinodermes et les téléostéens. Les bivalves sont les proies principales, surtout parmi la classe de taille de 16-26 cm LT. Les crustacés amphipodes et copépodes sont les proies principales des individus de taille inférieure à 16 cm LT. Les proportions de crustacés décapodes et de téléostéens ont augmenté avec la croissance en taille du marbré. Au niveau spécifique, les bivalves *Dosinia lupinus* (%IRI = 6,8) et *Telinella pulchella* (%IRI = 3,1), puis les crustacés décapodes *Liocarnicus depurator* (%IRI = 2,6), ont été les proies les plus fréquentes. La composition du régime alimentaire a montré peu de variations saisonnières : les bivalves ont été dominants quelles que soient les saisons, et particulièrement en hiver. La plus faible intensité d'alimentation enregistrée en hiver pourrait être liée à une plus faible température de la mer à cette période. Le marbré est un poisson actif dans la recherche de sa nourriture. Le régime alimentaire du marbré est composé de divers groupes benthiques, avec un large panel de taille et de morphologie de ses proies.

Key words. - Sparidae - *Lithognathus mormyrus* - MED - Adriatic Sea - Diet.

The striped sea bream, *Lithognathus mormyrus* (Linnaeus, 1758) is a commercially valuable fish, widely distributed in Mediterranean Sea (except Black Sea), Atlantic (from Bay of Biscay to Cape of Good Hope), Red Sea and south-western Indian Ocean, inhabiting littoral waters (Bauchot and Hureau, 1986). It is common in the Adriatic Sea on sandy or sandy-muddy bottoms as well as sea grass-beds, mostly between depths of 10-30 m (Jardas, 1996). In the eastern central Adriatic, striped sea bream spawns throughout summer (Kraljević *et al*., 1995). In the eastern Adriatic, *L. mormyrus* landing statistics are unreliable, but catches are estimated at 4 tonnes a year (Jardas, 1996). Although different aspects of its biology have been studied in the Adriatic Sea (Kraljević *et al*., 1995, 1996), studies on diet are relatively scarce. Only two studies have provided some limited observation on diet of the striped sea bream in the western part of the Adriatic Sea (Froglia, 1977; Fabi *et al*., 2006). Froglia (1977) noted various types of bottom living invertebrates in its diet. A study by Fabi *et al*. (2006) on limited samples (n = 108) collected only in summer and autumn, revealed that decapods and molluscs dominated in the stomach contents. On the other hand, studies on diet have not yet been analysed in the eastern Adriatic Sea. The literature referring to other areas is also not extensive. Suau (1970) reported on striped sea bream diet in the western Mediterranean. Badalamenti *et al*. (1993) provide information on the diet of *L. mormyrus* in the northwestern coastal

(1) Department of Biology, Faculty of Natural Science and Mathematics, University of Split, Teslina 12, 21000 Split, CROATIA. [antonela.paladin@pmfst.hr]
(2) Elementary School Lučac, Omiška Street 27, 21000, Split, CROATIA. [elez@hinet.hr]
* Corresponding author [msantic@pmfst.hr]

waters of Sicily, whereas Kallianotis *et al*. (2005) analysed feeding habits of this species in Greek waters.

The purpose of the present study was to examine a diet of the striped sea bream in the eastern central Adriatic Sea. The effects of predator size and season on stomach contents were included to provide a more comprehensive examination of the trophic ecology of this species.

MATERIAL AND METHODS

Samples of striped sea bream were collected from four different locations in the eastern central Adriatic Sea in shallow infralittoral areas, at depths between 5 and 35 m (Fig. 1).

Fishing was performing by trammel bottom nets (32 m long, 1.8 m high, with external netting panels of 112 mm mesh size and internal netting panels of 28 stretched mesh size) and gill nets (60 mm stretched mesh size and ropes which surround the fish site). The fish harvesting is done with a special 4-sided net (10 m x 10 m; 28 mm stretched mesh size) with leadline but without floatline. Fish sampled was done during daylight hours (from 08:00 to 18:00).

A total of 524 specimens were collected from January to December 2008: 110 specimens during winter, 116 during spring, 156 during summer and 142 during autumn. Total length (TL) of fish was measured to the nearest 0.1 cm and wet weight to the nearest 0.1 g. Immediately after capture, fish were dissected and the gut were removed and preserved in 4% formalin solution. Evidence of regurgitation was never observed in any fish. Prey was identified to the lowest taxonomic level possible. Species abundance and blotted wet weight (± 0.001 g) were recorded. The algae and sea grass fraction was excluded from diet analysis because it was recorded as undigested food and probably ingested by the fish together with other attached prey items.

TL sample size ranged from 12.8 to 31.7 cm ($\bar{x}$ = 22.72 ± 1.95 cm). Figure 2 showed the TL distribution of 524 individuals of striped sea bream caught in the study area (each column represents number of collected fish during seasons). In order to evaluate variation in food habits as function of size, specimens from 16 to 26 cm were separated into 2 five-centimetre length classes. Due to small sample sizes at other fish lengths, the remaining fish were separated into two size classes: < 16 cm (N = 62) and > 26 cm (N = 57). Sample size sufficiency with respect to size classes and seasons were assessed by cumulative prey curves and *a priori* power analysis (Hurtubia, 1973; Cohen, 1988; Ferry and Cailliet, 1996).

In the present study, the following indices were used:

Vacuity index (VI) = number of empty stomachs divided by total number of stomachs x 100;

Percentage frequency of occurrence (%F) = number of stomachs in which a food item was found, divided by the total number of non-empty stomachs, x 100;

Percentage numerical abundance (%Cn) = number of each prey item in all non-empty stomachs, divided by the total number of food items in all stomachs, x 100;

Percentage gravimetric composition (%Cw) = wet weight of each prey item, divided by the total weight of stomach contents, x 100.

The main food items were identified using the Index of Relative Importance (IRI) of Pinkas *et al*. (1971) and modi-

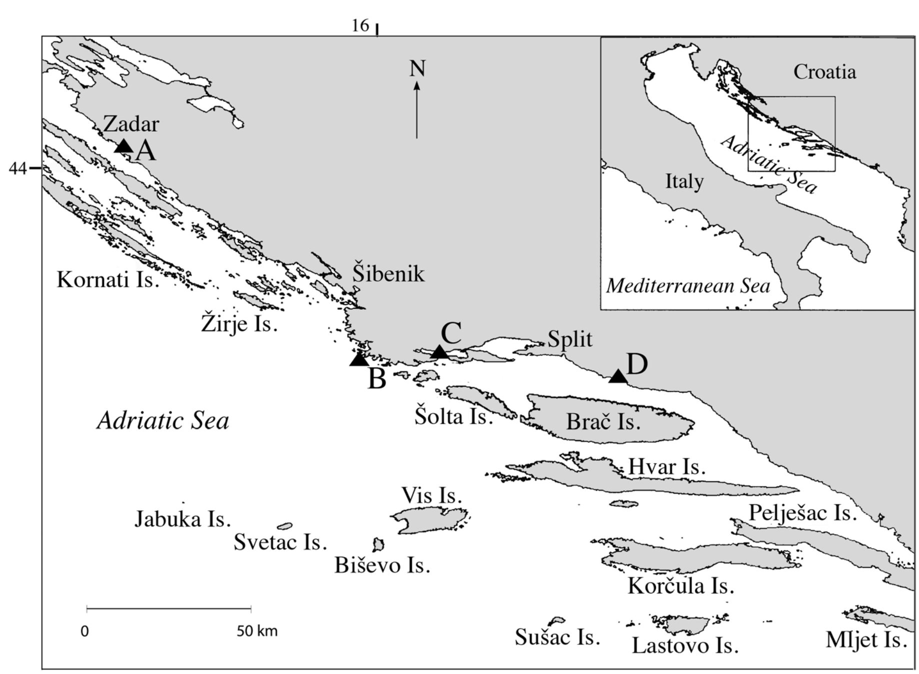

Figure 1. - Study area and sampling stations of *Lithognathus mormyrus* in the eastern central Adriatic Sea. A: Coasts of Zadar; B: Coasts of Rogoznica; C: Marina Bay; D: Coasts of Omić.

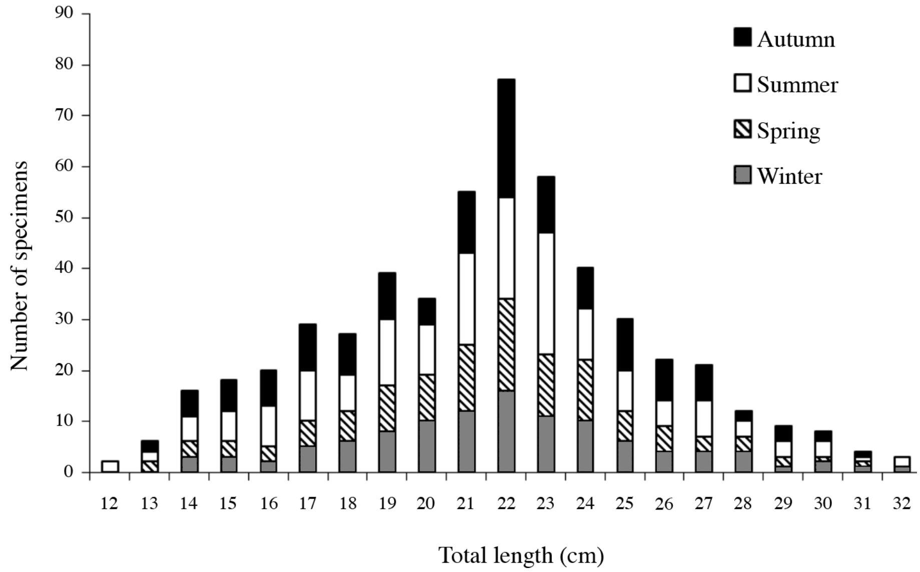

Figure 2. - Length-frequency distribution of *Lithognathus mormyrus* specimens from all seasons, caught in the eastern central Adriatic Sea (n = 524).

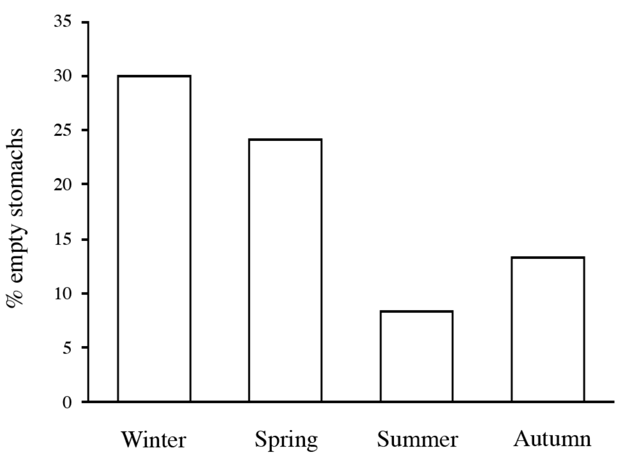

Figure 3. - Variation in percentage of empty stomachs of *Lithognathus mormyrus* throughout the year.

fied by Hacunda (1981):

$$IRI = \%F \times (\%Cn + \%Cw)$$

The index was expressed as:

$$\%IRI = (IRI/\sum IRI) \times 100$$

Prey species were sorted in decreasing order according to IRI and then cumulative %IRI was calculated.

Statistical differences ($p < 0.05$) in diet composition with respect to length class and season were assessed by a chi-square test (Sokal and Rohlf, 1981) of the frequencies of a given prey. The variation in vacuity index (VI) was also tested by a chi-square test of a contingency table with the number of empty stomachs.

After checking the normality of each variable and the homogeneity of variances (Zar, 1984), the effects of length class and season on the mean number (Nm/ST) of prey items and mean weight per stomach (Wm/ST) were tested by analysis of variance (ANOVA). Tukey's test was employed to locate the source of significant differences (Zar, 1984).

Proportional food overlap between predator size classes and seasons was calculated using Schoener's (1970) dietary overlap index: $C_{xy} = 1 - 0.5 \sum \left| P_{xi} - P_{yi} \right|$, where P_{xi} and P_{yi} are the proportion of prey *i* (based on %IRI) found in the diet of groups *x* and *y*. This index ranges from 0 (no prey overlap) to 1 (all food items in equal proportions). Schoener's index values above 0.6 are usually considered to indicate significant overlap (Wallace, 1981).

RESULTS

Feeding intensity

Of the 524 stomachs of striped sea bream examined, 93 were empty (17.7%). The proportion of empty stomachs varied significantly over the year ($\chi^2 = 15.3$, $p < 0.05$) with a maximum of 30.0% during winter and minimum of 8.3% during summer (Fig. 3). Percentage of empty stomachs among size classes ranged: 16.8% (size class 21-26 cm), 17.4% (size class 16-21 cm), 18.9% (size class < 16 cm) and 20.0% (size class > 26 cm). No significant differences ($\chi^2 = 0.94$, $p > 0.05$) were found in the percentage of empty stomachs among size classes.

Diet composition

Prey items identified in stomachs belong to eight major groups: Bivalvia, Gastropoda, Polychaeta, Decapoda, Amphipoda, Copepoda, Echinodermata and Teleostei (Tab. I). Bivalves were the most important ingested prey group, constituting 47.0% of the total IRI, followed by decapod crustaceans (%IRI = 18.0) and echinoderms (%IRI = 10.3) while prey groups such as teleosts (%IRI = 8.7), polychaetes (%IRI = 7.4), amphipods (%IRI = 3.8), gastropods

Table I. – Diet composition of 431 stomachs of *Lithognathus mormyrus* containing food. %F = frequency of occurrence; %Cn = percentage numerical composition; %Cw = percentage gravimetric composition; IRI = index of relative importance).

Food items	%F	%Cn	%Cw	IRI	%IRI
Mollusca					
Gastropoda					
Gibula sp.	1.6	1.3	2.7	6.4	0.3
Nassa sp.	1.1	1.3	1.3	2.9	0.1
Unidentified Gastropoda	3.2	2.3	4.2	20.8	0.8
Total Gastropoda	4.5	4.9	8.2	58.9	2.4
Bivalvia					
Dosinia lupinus	11.3	10.7	4.1	167.2	6.8
Telinella pulchella	9.4	5.9	2.4	78.0	3.1
Donax trunculus	7.4	5.7	2.4	59.9	2.4
Venus verrucosa	5.2	3.2	1.8	26.0	1.0
Scrobularia plana	2.4	1.7	2.3	9.6	0.4
Nucula sp.	2.2	1.7	2.3	8.8	0.3
Cardium sp.	2.0	1.6	2.2	7.6	0.3
Tellina sp.	1.7	1.1	1.1	4.7	0.2
Cerastoderma glaucum	1.7	1.3	1.1	4.0	0.1
Unidentified Bivalvia	9.9	7.0	8.8	156.4	6.3
Total Bivalvia	16.7	39.9	29.4	1157.3	47.0
Polychaeta					
Nephtys sp.	3.0	1.5	2.5	12.0	0.5
Sternapsis sp.	2.2	1.0	1.3	5.0	0.2
Unidentified Polychaeta	8.9	5.4	6.7	107.7	4.4
Total Polychaeta	9.9	7.9	10.5	182.1	7.4
Crustacea					
Decapoda					
Liocarnicus depurator	7.9	3.5	4.8	65.5	2.6
Liocarnicus maculatus	6.4	3.4	3.6	44.8	1.8
Processa sp.	4.9	2.6	3.0	27.4	1.1
Palaemon sp.	2.4	2.0	2.3	10.3	0.4
Palaemon elegans	2.0	1.2	2.4	7.2	0.3
Unidentified Decapoda	4.9	3.6	6.1	47.5	1.9
Total Decapoda	11.4	16.3	22.5	442.3	18.0
Amphipoda					
Gammarus sp.	4.0	3.4	2.4	13.6	0.5
Unidentified Amphipoda	4.9	5.1	2.8	38.7	1.6
Total Amphipoda	6.9	8.5	5.2	94.5	3.8
Copepoda					
Unidentified Copepoda	7.4	5.0	2.7	37.0	2.4
Echinodermata					
Echinocyamus pusillus	6.2	4.4	5.2	59.5	2.4
Ophiura sp.	2.4	1.3	2.1	8.1	0.3
Unidentified Echinodermata	8.4	5.7	2.4	68.0	2.7
Total Echinodermata	12.1	11.4	9.7	255.3	10.3
Teleostei					
Gobius sp.	5.4	2.4	7.9	55.6	2.2
Unidentified Teleostei	8.0	3.2	3.7	55.2	2.2
Total Teleostei	12.4	5.6	11.6	213.3	8.7

(%IRI = 2.4) and copepods (%IRI = 2.4) were comparatively lower and of less importance. Due to the advanced degree of digestion, identification to the species level was often impossible. Most common identifiable prey were the bivalves *Dosinia lupinus* (%IRI = 6.8), *Telinella pulchella* (%IRI = 3.1), *Donax trunculus* (%IRI = 2.4), decapods *Liocarcinus depurator* (%IRI = 2.6), *Liocarcinus maculatus* (%IRI = 1.8), and echinoderms *Echinocyamus pusillus* (%IRI = 2.4)

Food in relation to fish size

Table II displays the stomach contents for size classes of striped sea bream with regard to frequency of occurrence, numerical composition, weight composition and Index of Relative Importance of the eight major groups. Frequency of occurrence, numerical index, and IRI indicates that amphipods and copepods were the most important prey group in smallest size classes (< 16 cm TL). Amphipod and copepod IRI decreased with fish size, whereas decapod, teleost and bivalve IRI increased. The numerical composition and biomass of bivalves had higher relevance in fish from 16 to 26 cm. In the largest size class (> 26 cm TL), decapods together with bivalves and teleosts represent most important prey. Echinoderms and polychaetes were present in all size classes but relatively in low quantities. A chi-square analysis revealed significant differences between ingestion by striped sea bream size of bivalves ($\chi^2 = 10.4$, $p < 0.05$), decapods ($\chi^2 = 13.5$, $p > 0.05$), copepods ($\chi^2 = 29.9$, $p > 0.05$), amphipods ($\chi^2 = 22.1$, $p > 0.05$) and teleosts ($\chi^2 = 12.9$, $p > 0.05$). No-significant values were found for echinoderms ($\chi^2 = 2.8$, $p > 0.05$), polychaetes ($\chi^2 = 3.2$, $p > 0.05$) and gastropods ($\chi^2 = 0.5$, $p > 0.05$).

The mean weight of the stomach contents (Wm/ST) varied significantly among size classes (ANOVA, $F = 18.9$, $p < 0.05$). Mean weight of the stomach contents for specimens larger than 21 cm, differed significantly from others (Fig. 4). The mean number of prey (Nm/ST) decreased with increasing size of fish. However, those changes were not significant (ANOVA, $F = 2.90$, $p > 0.05$) (Fig. 4).

Values of Schoener's overlap index (< 0.6) reveal quantitative differences in diet between smaller specimens (< 16 cm TL) and individuals larger than 16 cm in TL. High values of

Table II. - Diet composition for each size class of *Lithognathus mormyrus* with regard to the percentage frequency occurrence (%F), percentage of numerical composition (%Cn), percentage of gravimetric index (%Cw) and index of relative importance (IRI).

Size class	< 16 cm				16-21cm				21-26 cm				> 26 cm			
Prey groups	% F	% Cn	% Cw	IRI	% F	%Cn	%Cw	IRI	% F	%Cn	% Cw	IRI	% F	%Cn	% Cw	IRI
Gastropoda	8.0	2.5	9.8	98.4	4.3	4.7	7.7	53.3	8.0	2.6	3.7	50.4	-	-	-	-
Copepoda	38.0	24.7	12.7	1421	3.6	3.0	1.5	16.2	-	-	-	-	-	-	-	-
Amphipoda	40.0	29.4	16.0	1816	8.9	4.7	5.8	93.4	-	-	-	-	-	-	-	-
Polychaeta	24.0	7.0	18.6	614	16.6	8.3	11.6	330.3	9.2	3.9	5.6	87.4	19.5	7.9	3.7	226.2
Teleostei	-	-	-	-	4.4	3.5	7.6	47.7	15.1	12.0	16.8	434.9	57.2	23.5	27.9	2940.0
Echinodermata	28.0	7.0	12.9	557	17.8	11.1	13.5	437.8	14.0	7.7	10.9	260.4	26.0	10.6	4.5	392.6
Decapoda	18.0	5.9	7.6	243	15.2	23.5	12.3	620.1	15.7	31.2	26.5	905.8	52.1	31.6	31.2	3271.8
Bivalvia	24.0	23.5	22.4	1101	19.0	41.1	34.9	1401.2	15.1	42.6	36.5	1194.4	52.1	24.5	32.7	2980.1

Table III. - Proportional food overlap coefficients (Schoener's index) of the diet between size classes of *Lithognathus mormyrus*.

Size class (cm TL)	< 16	16 - 21	21 - 26	> 26
< 16	-			
16 -21	0.63	-		
21 - 26	0.44	0.78	-	
> 26	0.41	0.67	0.83	-

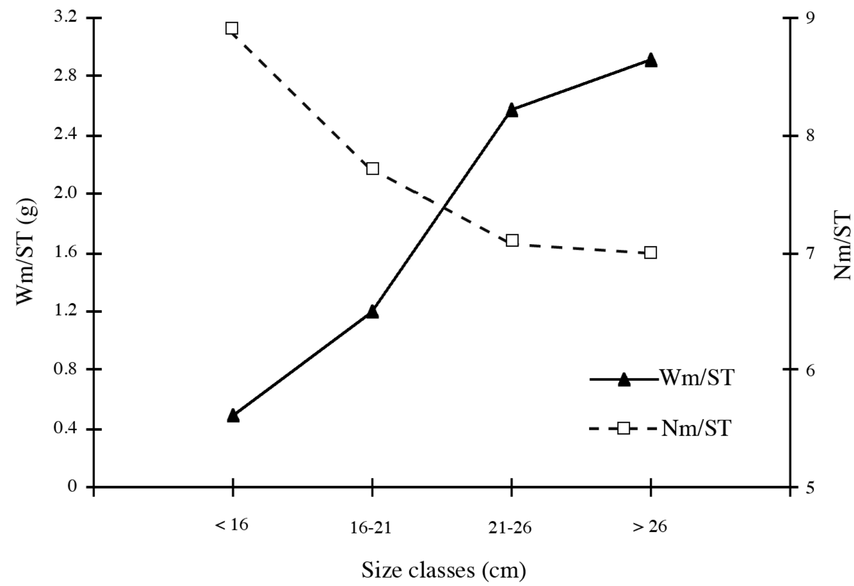

Figure 4. - Variation of the mean weight of prey per stomach (Wm/ST) and mean number of prey items per stomach (Nm/ST) of *Lithognathus mormyrus* among size classes.

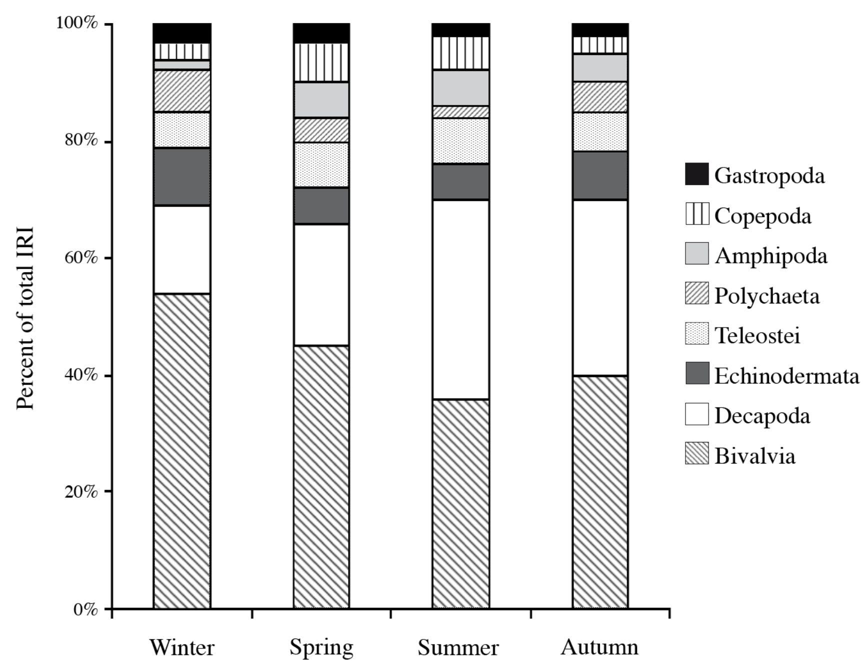

Figure 5. - Diet composition of *Lithognathus mormyrus* throughout the year, based on the %IRI values of the major prey groups.

food overlap coefficients were observed between largest size classes (21-26 and > 26 cm TL) (Tab. III).

Seasonal variation in the diet composition

There was a low seasonal variation in food habits of *L. mormyrus* within the studied area (Fig. 5). Bivalves were the dominant prey group during all seasons, particularly in winter (%IRI = 53.9) and spring (%IRI = 45.2). Decapods were also present in the stomachs throughout the year, with a peak value recorded in summer (%IRI = 34.3). Other prey groups were also present in the stomachs throughout the year, but in smaller quantities.

Significant differences among seasons were found for bivalves ($\chi^2 = 19.6$, $p < 0.05$) and decapods ($\chi^2 = 15.5$, $p < 0.05$). A chi-square analysis revealed no-significant differences for gastropods ($\chi^2 = 0.2$, $p > 0.05$), polychaetes ($\chi^2 = 1.4$, $p > 0.05$), amphipods ($\chi^2 = 2.9$, $p > 0.05$), copepods ($\chi^2 = 3.1$, $p > 0.05$), echinoderms ($\chi^2 = 0.5$, $p > 0.05$) and teleosts ($\chi^2 = 2.3$, $p > 0.05$).

The mean weight (Wm/ST) of prey items varied significantly throughout the year (ANOVA, $F = 18.4$, $p < 0.05$) and was significantly greater (Tukey's test) in summer-autumn seasons (Fig. 6). The mean number (Nm/ST) of prey items showed a tendency to increase from winter to summer season, but not significantly (ANOVA, $F = 3.77$, $p > 0.05$). High values of food overlap coefficients were observed between summer and autumn (0.90). However, Schoener's index indicating high degree of diet overlaps between any seasons (Tab. IV).

Table IV. - Seasonal proportional food overlap coefficients (Schoener's index) of the diet of *Lithognathus mormyrus*.

Seasons	Winter	Spring	Summer	Autumn
Winter	-			
Spring	0.84	-		
Summer	0.71	0.86	-	
Autumn	0.81	0.88	0.90	-

DISCUSSION

Present results indicate that *L. mormyrus* populations inhabiting the eastern central Adriatic Sea are carnivorous fish. According to total IRI, bivalves were the most abundant prey group in the diet, and therefore they can be classified as the main food source for striped sea bream in this area. Decapods are secondary prey, except for larger fish (> 26 cm), to who, bivalves and teleosts are the most important prey. Other prey systematic groups (copepods, amphipods, gastropods, polychaetes, echinoderms and teleosts) were of less importance and they indicate occasional food. Conversely, copepods and amphipods constituted the main prey in stomach contents of smaller individuals. Fabi *et al*. (2006) reported that decapods and bivalves were more abundant in the stomach contents of striped sea bream sampled on artificial reefs in the western Adriatic. In the Italian and Hellenic waters, bivalves with polychaetes constituted the main prey in the diet of this fish (Badalamenti *et al*., 1993; Kallianiotis *et al*., 2005). Variation in the prey importance could be related to the presence/availability of different benthic assemblages among regions. Taken together, the results of these studies confirm the importance of bivalves in the diet of striped sea bream.

Exoskeletons (such as decapods) or shells (bivalves) often constitute the major evidence of the principal prey groups in the *L. mormyrus* diet. For that reason this species had special teeth for crumbling. Jaws are heterodont with teeth differentiated in incisors (front teeth) and molars (the rest), set in 3 to 4 rows (Elez, 2006). Molar teeth are strong and their function is to crush the hard body parts (Onofri, 1986). The pattern of stomach contents of striped sea bream in the present study seem to agree with the field distribution patterns of several benthic species that inhabit soft sediment grounds. Bivalves (*Dosinia lupinus* and *Telinella pulchella*), decapods (*Liocarcinus* and *Processa* genus) and amphipods

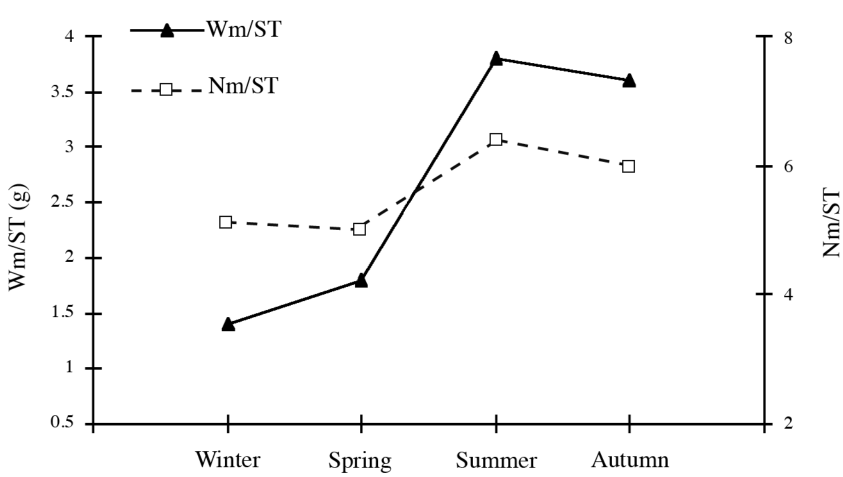

Figure 6. - Variation of the mean weight of prey per stomach (Wm/ST) and mean number of prey items per stomach (Nm/ST) of *Lithognathus mormyrus* throughout the year.

(*Gammarus* genus) are common in sandy-muddy bottoms (Števčić, 1990; Milišić, 2007; Milišić, 2008). Burrowing species (*Liocarcinus depurator, L. maculatus*) and species that live within substratum (*Dosinia lupinus*, *Venus verrucosa, Tellina* sp.) found in the stomach contents indicated that striped sea bream is able to collect these prey out of their burrows in the sediment. The common presence of sand grain and pieces of undigested algae associated with benthic organisms suggests that *L. mormyrus* is a active seeking bottom feeder (Kallianiotis *et al*., 2005). This similar feeding behaviour was observed in the western Adriatic (Froglia, 1977), eastern Spanish coast (Suau, 1970) and northwest coast of Sicily (Badalamenti *et al*., 1993).

The food composition and dietary overlap reveal significantly changed in the diet of striped sea bream with its growth. Smaller specimens (< 16 cm TL) mainly feed on amphipods and copepods both contributing with reduced prey biomass. As the fish growth, bivalves and decapods proportion increase in importance as amphipods and copepods diminished its relevance. In this respect the mean weight of prey (Wm/ST) significantly increases towards the larger size classes as a consequence of the presence of teleosts in addition to decapods and bivalves. Data obtained in this study regarding the shift of the major food items are consistent with those of Froglia (1977) who reported that smaller specimens of *L. mormyrus* from western Adriatic coast consume more copepods, cumaceans and juveniles of polychaetes, often switching to echinoderms, decapods, bivalves and teleosts as they increase in length. Ontogenetic variation in the food resources could be related to the ability of larger specimens to grind hard parts of animals such as shells of bivalves and to capture larger animals (Kallianiotis *et al*., 2005). The ontogenetic shift in feeding habits is a general phenomenon among fish as result of increasing body size. Mean prey size increases with increasing predator size in order to optimizing the energy input for growth (Ross, 1977; Stoner and Livingston, 1984). Moreover, trophic ontogeny of striped sea bream could be explained in terms of fish morphology. The width and gape of mouth are linearly related to the fish size (Ross, 1978; Stoner, 1980) and increased body and mouth size permit fish to capture a broader range of prey size and prey types. Such changes in food habits according to fish size could decrease intraspecific competition (Langton, 1982).

Low seasonal variation in the diet of striped sea bream was noticed within study area. Values of Schoener's index (> 0.60) indicated high dietary overlap between seasons. Bivalves dominated the diet composition throughout the year, particularly in winter. Increased decapods consumption during summer coincides with the period of the new recruits of many decapods species, which may be present in the high densities (Robertson, 1984; Milišić, 2008). On the other hand, in Hellenic waters (Thracian Sea), it was observed considerable seasonal variation in the diet of striped sea bream (Kallianiotis *et al*., 2005). Bivalves dominated in spring, amphipods in winter, while polychaetes were more frequently prey in other seasons. These changes may be correlated to the seasonal variation in food availability (Kallianiotis *et al*., 2005).

In our study a high percentage of non-empty stomachs (82.3%) were found in the collected fish. Similarly to striped sea bream, high degrees of stomach fullness were reported for other demersal fish in the Adriatic Sea, such as *Scorpaena porcus* (Jardas and Pallaoro, 1991) and *Diplodus annularis* (Matić-Skoko *et al*., 2004). This indicates an abundance of potential prey in this region even though this region belongs, according to Buljan and Zore-Armanda (1976) to relatively oligotrophic part of the Adriatic Sea. The abundance of prey in this region is related with upwelling events in the area of Palagruža, located in the vicinity of the studied area (Regner *et al*., 1987).

Feeding intensity is negatively related to the percentage of empty stomachs (Bowman and Bowman, 1980). In our study, the significantly highest values ($p < 0.05$) of stomach emptiness were recorded during the winter. In addition, the values of mean weight (Wm/ST), which were significantly highest ($p < 0.05$) in summer-autumn, and were lowest in winter-spring period. Different factors may cause a decrease in the feeding activity in fish (Nikolsky, 1976). Many demersal fishes show a decrease in the feeding rate as the temperature drops (Tyler, 1971), particularly those with thermophilous characteristics and with spring and summer spawning. Poorer feeding intensity in winter could be related to lower seawater temperatures in the study area (Zore-Armanda *et al*., 1991), which slowly lowers the metabolism, and thereby further results in reduced feeding. Because of the reduced abundance of prey and lowered metabolism of the fish, predation of feed organisms was probably at a minimum during the winter. This assumption broadly agrees with the model of thermophilous fish growth from seas of medium geographic latitudes (Cefali *et al*., 1987), which shows lowest growth rate in winter and in the beginning of spring. This is in agreement with striped sea bream behaviour since it spawns in summer in the sampling area. Intensified feeding extends throughout the summer probably to higher temperatures and prey availability. In Adriatic waters many groups of benthic organisms are present in higher abundance and density during warmer part of year (Baranović *et al*., 1992).

In conclusion, *L. mormyrus* is an active seeking bottom feeder whose diet in the Adriatic Sea as well as in the Italian and Hellenic waters, consists of diverse benthic groups, with wide range of size and morphology. In the eastern central Adriatic Sea bivalves were the most important prey in all seasons as well as in large specimens, whereas copepods and amphipods constituted the main prey in stomach of smaller individuals. Present data is a step ahead to improve knowledge on the feeding ecology of striped sea bream.

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